Instructions: Try these problems from the textbook as practice (answers below).

Problems

2-12. Find vector, parametric, and symmetric equations for the line...

3. through the point $(2, 2.4, 3.5)$ and parallel to the vector $3\mathbf{i} + 2\mathbf{j} - \mathbf{k}$.
5. through the point $(1, 0, 6)$ and perpendicular to the plane $x + 3y + z = 5$.
7. through the points $(0, \frac{1}{2}, 1)$ and $(2, 1, -3)$.
9. through the points $(-8, 1, 4)$ and $(3, -2, 4)$.
11. through $(-6, 2, 3)$ and parallel to the line $\frac{1}{2}x = \frac{1}{3}y = z + 1$.

13. Is the line through $(-4, -6, 1)$ and $(-2, 0, -3)$ parallel to the line through $(10, 18, 4)$ and $(5, 3, 14)$?

15. Find symmetric equations for the line that passes through the point $(1, -5, 6)$ and is parallel to the vector $\langle -1, 2, -3\rangle$. Where does this line intersect each coordinate plane?

17. Find a vector equation for the line segment from $(6, -1, 9)$ to $(7, 6, 0)$.

19. Are the lines L_1 and L_2 are parallel, skew, or intersecting? If they intersect, find their intersection.

$$\begin{aligned} L_1: &\quad x = 3 + 2t, &\quad y = 4 - t, &\quad z = 1 + 3t \\ L_2: &\quad x = 1 + 4s, &\quad y = 3 - 2s, &\quad z = 4 + 5s \end{aligned}$$

23-40. Find an equation of the plane...

23. through the point $(3, 2, 1)$ and with the normal vector $5\mathbf{i} + 4\mathbf{j} + 6\mathbf{k}$.
27. through the point $(1, 3, -1)$ and perpendicular to the line $\dfrac{x+3}{4} = -y = \dfrac{z-1}{5}$.
29. through the point $(2.1, 1.7, -0.9)$ and parallel to the plane $2x - y + 3z = 1$.
31. through the points $(0, 1, 1)$, $(1, 0, 1)$, and $(1, 1, 0)$.
33. through points $(2, 1, 2)$, $(3, -8, 6)$, and $(-2, -3, 1)$.
35. that passes through $(3, 5, -1)$ and contains $x = 4 - t, y = 2t - 1, z = -3t$.
37. passing through $(3, 1, 4)$ and containing the line of intersection of $x + 2y + 3z = 1$ and $2x - y + z = -3$.
39. that passes through the point $(1, 5, 1)$ and is perpendicular to the planes $2x + y - 2z = 2$ and $x + 3z = 4$.

41-44. Use intercepts to help sketch the planes $2x + 5y + z = 10$ and $6x - 3y + 4z + 6$.

45-47. Find the point at which the given line and plane intersect.

45. $x = 2 - 2t, y = 3t, z = 1 + t$ and $x + 2y - z = 7$.
47. $5x = \frac{1}{2}y = z + 2$ and $10x - 7y + 3z + 24 = 0$.

51-56. Find the angle θ between the given planes. Are they parallel, perpendicular, or neither?

51. $x + 4y - 3z = 1$ and $-3x + 6y + 7z = 0$.
53. $x + 2y - z = 2$ and $2x - 2y + z = 1$.
55. $2x - 3y = z$ and $4x = 3 + 6y + 2z$.

57. Find the intersection of $x + y + z = 1$ and $x + 2y + 2z = 1$. Also find the angle between the planes.

59. Find symmetric equations for the line of intersection of the planes $5x - 2y - 2z = 1$ and $4x + y + z = 6$.

61. Find an equation for the plane consisting of all points that are equdistant from the points $(1, 0, -2)$ and $(3, 4, 0)$.

63. Find an equation of the plane with x-intercept a, y-intercept b, and z-intercept c.

65. Find an equation for the line through the point $(0, 1, 2)$ that is parallel to the plane $x + y + z = 2$ and perpendicular to the line $x = 1 + t, y = 1 - t, z = 2t$.

71. Find the distance from the point $(1, -2, 4)$ to the plane $3x + 2y + 6z = 5$.

73. Find the distance between the parallel planes $2x - 3y + z = 4$ and $4x - 6y + 2z = 3$.

Answers

3. $\ell(t) = t\langle 3,2,-1\rangle + \langle 2,2.4,3.5\rangle$;
$x = 2+3t, y = 2.4+2t, z = 3.5+-1t$;
$\dfrac{x-2}{3} = \dfrac{y-2.4}{2} = \dfrac{z-3.5}{-1}$

5. $\ell(t) = t\langle 1,3,1\rangle + \langle 1,0,6\rangle$;
$x = 1+1t, y = 0+3t, z = 6+1t$;
$\dfrac{x-1}{1} = \dfrac{y-0}{3} = \dfrac{z-6}{1}$

7. $\ell(t) = t\left\langle 2,\frac{1}{2},-4\right\rangle + \langle 2,1,-3\rangle$;
$x = 2+2t, y = 1+\frac{1}{2}t, z = -3+-4t$;
$\dfrac{x-2}{2} = \dfrac{y-1}{\frac{1}{2}} = \dfrac{z--3}{-4}$

9. $\ell(t) = t\langle 11,-3,0\rangle + \langle -8,1,4\rangle$;
$x = -8+11t, y = 1+-3t, z = 4+0t$;
$\dfrac{x+8}{11} = \dfrac{y-1}{-3}, z = 4$

11. $\ell(t) = t\langle 2,3,1\rangle + \langle -6,2,3\rangle$;
$x = -6+2t, y = 2+3t, z = 3+1t$;
$\dfrac{x--6}{2} = \dfrac{y-2}{3} = \dfrac{z-3}{1}$

13. Yes.

15. $\ell(t) = t\langle -1,2,-3\rangle + \langle 1,-5,6\rangle$;
$x = 1+-1t, y = -5+2t, z = 6+-3t$;
$\dfrac{x-1}{-1} = \dfrac{y--5}{2} = \dfrac{z-6}{-3}$.
Intersections occur at $(-1,-1,0)$, $(-\frac{3}{2},0,-\frac{3}{2})$, and $(0,-3,3)$.

17. $\ell(t) = (1-t)\langle 6,-1,9\rangle + t\langle 7,6,0\rangle$ for $0 \le t \le 1$.

19. Skew.

23. $5x+4y+6z = 29$

27. $4x-y+5z = -4$

29. $10x-5y+15z = -1$

31. $x+y+z = 2$

33. $5x-3y-8z = -9$

35. $8x+y-2z = 31$

37. $x-2y-z = -3$

39. $3x-8y-z = -38$

45. $(-2,6,3)$

47. $(\frac{2}{5},4,0)$

51. Perpendicular.

53. $\theta = \arccos(-1/\sqrt{6})$, Neither.

55. Parallel.

57. $\ell(t) = t\langle 0,-1,1\rangle + \langle 1,0,0\rangle$; $\theta = \arccos(5\sqrt{3}/9)$

59. $x = 1, y-2 = -z$

61. $x+2y+z = 5$

63. $x/a+y/b+z/c = 1$

65. $x = 0+3t, y = 1+-1t, z = 2+-2t$

71. $\dfrac{18}{7}$

73. $\dfrac{5}{2\sqrt{14}}$